What is claimed is:

1. A medium having instructions for performing steps for creating a regular model for a multi-stage separation process having feed trays, reboiler return trays and condenser return trays and one or more additional trays that allows said regular model to converge to a solution comprising:

(a) lumping each of said one or more additional trays into an associated compartment that comprises one or more of said one or more additional trays that are not in another associated compartment;

(b) treating said feed trays, reboiler return trays and said condenser return trays as one tray compartments;

(c) designating one of said one or more additional trays in each of said associated compartments comprising one or more additional trays as a sensitive tray;

(d) equating liquid holdup in each of said compartments to the total liquid holdup of the trays in each of said compartments;

(e) ignoring vapor holdup in each of said compartments;

(f) calculating phase equilibria in an associated compartment only for said sensitive tray;

(g) presuming that all trays other than said sensitive trays in each of said associated compartments respond instantaneously to liquid and vapor flow; and

(h) basing temperatures of all trays other than said sensitive trays in each of said associated compartments on linear interpolation between the temperature at each of two adjacent sensitive trays.

2. A medium having instructions for performing steps for creating an initialization model for a multi-stage separation process having feed trays for receiving a feed stream flow, reboiler return trays for providing a liquid flow to a reboiler and receiving from said reboiler a vapor flow and condenser return trays for

providing a vapor flow to a condenser and receiving from said condenser a liquid flow and one or more compartments with multiple trays having vapor and liquid streams flowing therethrough that generates a set of initial values for a regular model of said process, comprising:

(a) converting all differential equations in said regular model to steady state equations by setting the derivative term of all of said differential equations to zero;

(b) taking the temperature of said condenser return tray as the average of the temperatures of said liquid flow from said condenser and said feed stream flow;

(c) taking the temperature of said reboiler return tray as the average of the temperatures of said vapor flow from said reboiler and said feed stream flow;

(d) taking the liquid flow in said condenser return tray to be the same as said liquid flow from said condenser;

(e) taking the vapor flow in said reboiler return tray to be the same as said vapor flow from said reboiler;

(f) taking the liquid flow in said feed tray as the sum of said liquid flow from said condenser and said feed stream flow;

(g) assuming that all of said trays have 100% efficiency; and

(h) assuming there is no interaction between said vapor and liquid flows through said compartments with multiple trays.

3. A method for creating a regular model for a multi-stage separation process having feed trays, reboiler return trays and condenser return trays and one or more additional trays that allows said regular model to converge to a solution comprising:

(a) lumping each of said one or more additional trays into an associated compartment that comprises one

or more of said one or more additional trays that are not in another associated compartment;

(b) treating said feed trays, reboiler return trays and said condenser return trays as one tray compartments;

(c) designating one of said one or more additional trays in each of said associated compartments comprising one or more additional trays as a sensitive tray;

(d) equating liquid holdup in each of said compartments to the total liquid holdup of the trays in each of said compartments;

(e) ignoring vapor holdup in each of said compartments;

(f) calculating phase equilibria in an associated compartment only for said sensitive tray;

(g) presuming that all trays other than said sensitive trays in each of said associated compartments respond instantaneously to liquid and vapor flow; and

(h) basing temperatures of all trays other than said sensitive trays in each of said associated compartments on linear interpolation between the temperature at each of two adjacent sensitive trays.

4. A method of process engineering which comprises creating a regular model for a multi-stage separation process having feed trays, reboiler return trays and condenser return trays and one or more additional trays that allows said regular model to converge to a solution according to prescribed guidelines,

said guidelines comprising:

(a) lumping each of said one or more additional trays into an associated compartment that comprises one or more of said one or more additional trays that are not in another associated compartment;

(b) treating said feed trays, reboiler return trays and said condenser return trays as one tray compartments;

(c) designating one of said one or more additional

trays in each of said associated compartments comprising one or more additional trays as a sensitive tray;

(d) equating liquid holdup in each of said compartments to the total liquid holdup of the trays in each of said compartments;

(e) ignoring vapor holdup in each of said compartments;

(f) calculating phase equilibria in an associated compartment only for said sensitive tray;

(g) presuming that all trays other than said sensitive trays in each of said associated compartments respond instantaneously to liquid and vapor flow; and

(h) basing temperatures of all trays other than said sensitive trays in each of said associated compartments on linear interpolation between the temperature at each of two adjacent sensitive trays.

5. A method for creating an initialization model for a multi-stage separation process having feed trays for receiving a feed stream flow, reboiler return trays for providing a liquid flow to a reboiler and receiving from said reboiler a vapor flow and condenser return trays for providing a vapor flow to a condenser and receiving from said condenser a liquid flow and one or more compartments with multiple trays having vapor and liquid streams flowing therethrough that generates a set of initial values for a regular model of said process, comprising:

(a) converting all of differential equations in said regular model to steady state equations by setting the derivative term of all of said differential equations to zero;

(b) taking the temperature of said condenser return tray as the average of the temperatures of said liquid flow from said condenser and said feed stream flow;

(c) taking the temperature of said reboiler return tray as the average of the temperatures of said vapor

flow from said reboiler and said feed stream flow;

(d) taking the liquid flow in said condenser return tray to be the same as said liquid flow from said condenser;

(e) taking the vapor flow in said reboiler return tray to be the same as said vapor flow from said reboiler;

(f) taking the liquid flow in said feed tray as the sum of said liquid flow from said condenser and said feed stream flow;

(g) assuming that all of said trays have 100% efficiency; and

(h) assuming there is no interaction between said vapor and liquid flows through said compartments with multiple trays.

6. A method of process engineering which comprises creating an initialization model for a multi-stage separation process having feed trays for receiving a feed stream flow, reboiler return trays for providing a liquid flow to a reboiler and receiving from said reboiler a vapor flow and condenser return trays for providing a vapor flow to a condenser and receiving from said condenser a liquid flow and one or more compartments with multiple trays having vapor and liquid streams flowing therethrough that generates a set of initial values for a regular model of said process, according to prescribed guidelines,

said guidelines comprising:

(a) converting all differential equations in said regular model to steady state equations by setting the derivative term of all of said differential equations to zero;

(b) taking the temperature of said condenser return tray as the average of the temperatures of said liquid flow from said condenser and said feed stream flow;

(c) taking the temperature of said reboiler return

tray as the average of the temperatures of said vapor flow from said reboiler and said feed stream flow;

(d) taking the liquid flow in said condenser return tray to be the same as said liquid flow from said condenser;

(e) taking the vapor flow in said reboiler return tray to be the same as said vapor flow from said reboiler;

(f) taking the liquid flow in said feed tray as the sum of said liquid flow from said condenser and said feed stream flow;

(g) assuming that all of said trays have 100% efficiency; and

(h) assuming there is no interaction between said vapor and liquid flows through said compartments with multiple trays.

7. A computer executable model for a multi-stage separation process having feed trays, reboiler return trays and condenser return trays and one or more additional trays comprising:

(a) each of said one or more additional trays lumped into an associated compartment that comprises one or more of said one or more additional trays that are not in another associated compartment;

(b) said feed trays, reboiler return trays and said condenser return trays each treated as one tray compartments;

(c) one of said one or more additional trays in each of said associated compartments comprising one or more additional trays designated as a sensitive tray;

(d) liquid holdup in each of said compartments equated to the total liquid holdup of the trays in each of said compartments;

(e) vapor holdup in each of said compartments ignored;

(f) phase equilibria in an associated compartment

calculated only for said sensitive tray;

(g) all trays other than said sensitive trays in each of said associated compartments are presumed to respond instantaneously to liquid and vapor flow; and

(h) temperatures of all trays other than said sensitive trays in each of said associated compartments are based on linear interpolation between the temperature at each of two adjacent sensitive trays.

8. A computer executable model for a multi-stage separation process having feed trays for receiving a feed stream flow, reboiler return trays for providing a liquid flow to a reboiler and receiving from said reboiler a vapor flow and condenser return trays for providing a vapor flow to a condenser and receiving from said condenser a liquid flow and one or more compartments with multiple trays having vapor and liquid streams flowing therethrough comprising:

(a) all differential equations in said computer executable model converted to steady state equations by setting the derivative term of all of said differential equations to zero;

(b) the temperature of said condenser return tray is taken as the average of the temperatures of said liquid flow from said condenser and said feed stream flow;

(c) the temperature of said reboiler return tray is taken as the average of the temperatures of said vapor flow from said reboiler and said feed stream flow;

(d) taking the liquid flow in said condenser return tray to be the same as said liquid flow from said condenser;

(e) taking the vapor flow in said reboiler return tray to be the same as said vapor flow from said reboiler;

(f) taking the liquid flow in said feed tray as the sum of said liquid flow from said condenser and said feed

stream flow;

(g) assuming that all of said trays have 100% efficiency; and

(h) assuming there is no interaction between said vapor and liquid flows through said compartments with multiple trays.

9. The medium of claim 1 further having instructions for performing steps for creating an initialization model for said process, said feed trays for receiving a feed stream flow, said reboiler return trays for providing a liquid flow to a reboiler and receiving from said reboiler a vapor flow and said condenser return trays for providing a vapor flow to a condenser and receiving from said condenser a liquid flow, said additional trays having vapor and liquid streams flowing therethrough, said instructions for performing steps for creating an initialization model generating a set of initial values for said regular model, said further instructions comprising:

(a) converting all differential equations in said regular model to steady state equations by setting the derivative term of all of said differential equations to zero;

(b) taking the temperature of said condenser return tray as the average of the temperatures of said liquid flow from said condenser and said feed stream flow;

(c) taking the temperature of said reboiler return tray as the average of the temperatures of said vapor flow from said reboiler and said feed stream flow;

(d) taking the liquid flow in said condenser return tray to be the same as said liquid flow from said condenser;

(e) taking the vapor flow in said reboiler return tray to be the same as said vapor flow from said reboiler;

(f) taking the liquid flow in said feed tray as the

sum of said liquid flow from said condenser and said feed stream flow;

(g) assuming that all of said trays have 100% efficiency; and

(h) assuming there is no interaction between said vapor and liquid flows through said compartments with one or more additional trays.

10. The method of claim 3 wherein said feed trays are for receiving a feed stream flow, said reboiler return trays are for providing a liquid flow to a reboiler and receiving from said reboiler a vapor flow and said condenser return trays are for providing a vapor flow to a condenser and receiving from said condenser a liquid flow, said additional trays have vapor and liquid streams flowing therethrough, said method also for creating an initialization model generating a set of initial values for said regular model and further comprising:

(a) converting all of differential equations in said regular model to steady state equations by setting the derivative term of all of said differential equations to zero;

(b) taking the temperature of said condenser return tray as the average of the temperatures of said liquid flow from said condenser and said feed stream flow;

(c) taking the temperature of said reboiler return tray as the average of the temperatures of said vapor flow from said reboiler and said feed stream flow;

(d) taking the liquid flow in said condenser return tray to be the same as said liquid flow from said condenser;

(e) taking the vapor flow in said reboiler return tray to be the same as said vapor flow from said reboiler;

(f) taking the liquid flow in said feed tray as the sum of said liquid flow from said condenser and said feed stream flow;

(g) assuming that all of said trays have 100% efficiency; and

(h) assuming there is no interaction between said vapor and liquid flows through said compartments with one or more additional trays.

11. The method of claim 4 wherein said feed trays are for receiving a feed stream flow, said reboiler return trays are for providing a liquid flow to a reboiler and receiving from said reboiler a vapor flow and said condenser return trays are for providing a vapor flow to a condenser and receiving from said condenser a liquid flow, said additional trays have vapor and liquid streams flowing therethrough, and said guidelines further comprise:

(a) converting all of differential equations in said regular model to steady state equations by setting the derivative term of all of said differential equations to zero;

(b) taking the temperature of said condenser return tray as the average of the temperatures of said liquid flow from said condenser and said feed stream flow;

(c) taking the temperature of said reboiler return tray as the average of the temperatures of said vapor flow from said reboiler and said feed stream flow;

(d) taking the liquid flow in said condenser return tray to be the same as said liquid flow from said condenser;

(e) taking the vapor flow in said reboiler return tray to be the same as said vapor flow from said reboiler;

(f) taking the liquid flow in said feed tray as the sum of said liquid flow from said condenser and said feed stream flow;

(g) assuming that all of said trays have 100% efficiency; and

(h) assuming there is no interaction between said

vapor and liquid flows through said compartments with one or more additional trays.

12. The computer executable model of claim 7 wherein said feed trays are for receiving a feed stream flow, said reboiler return trays are for providing a liquid flow to a reboiler and receiving from said reboiler a vapor flow and said condenser return trays are for providing a vapor flow to a condenser and receiving from said condenser a liquid flow, said additional trays have vapor and liquid streams flowing therethrough, said model further comprising:

(a) all differential equations in said computer executable model converted to steady state equations by setting the derivative term of all of said differential equations to zero;

(b) the temperature of said condenser return tray is taken as the average of the temperatures of said liquid flow from said condenser and said feed stream flow;

(c) the temperature of said reboiler return tray is taken as the average of the temperatures of said vapor flow from said reboiler and said feed stream flow;

(d) taking the liquid flow in said condenser return tray to be the same as said liquid flow from said condenser;

(e) taking the vapor flow in said reboiler return tray to be the same as said vapor flow from said reboiler;

(f) taking the liquid flow in said feed tray as the sum of said liquid flow from said condenser and said feed stream flow;

(g) assuming that all of said trays have 100% efficiency; and

(h) assuming there is no interaction between said vapor and liquid flows through said compartments with multiple trays.